Extending AAA Capabilities to Meet PPP Goals in Supply Chains

ManMohan S. Sodhi, m.sodhi@city.ac.uk, +44.20.7040.0276

Cass Business School, City, University of London, 106 Bunhill Row, London EC1Y 8TZ, UK

Christopher S. Tang, chris.tang@anderson.ucla.edu, +1(310) 825-4203

UCLA Anderson School, 110 Westwood Plaza Los Angeles, CA 90095, USA

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Abstract: A company must develop the "AAA" capabilities of agility, adaptability and alignment in its supply chain to compete in a dynamic global environment and do so profitably. However, as businesses face new challenges by way of increased expectations of environmental and social sustainability, they must expand their AAA supply chain capabilities to meet goals expanded from profits alone to people, planet and profits. This paper provides a framework for extending a company's capabilities needed for profitable supply chain management to those needed for achieving triple-bottom-line benefits.

***Keywords*:** AAA capabilities, supply chain management, stakeholders, triple bottom line, sustainability

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1. Introduction

This paper seeks to understand the change in supply-chain capabilities that is needed when performance objectives expand from profits alone to include environmental and social sustainability goals. We do so by conceptualizing how companies should extend their agility, adaptability, and alignment capabilities when they seek triple-bottom-line benefits for multiple stakeholders.

With globalization and complex supply chains with long lead times and many self-interested partners, there are unanticipated changes in demand and supply. To overcome the resulting challenges of matching supply and demand in global decentralized supply chains, Lee (2004) argued that companies must develop three "AAA" capabilities -- agility, adaptability, and alignment – for their supply chains. However, companies can no longer afford to focus solely on profitability goals; instead, they need to focus on the "triple bottom line" with *profit, people,* and *planet* (Elkington 2002) goals, or "PPP" in short. This is because economic, social, and environmental sustainability considerations are requiring companies to change their supply chains operations. Researchers too need to consider the interests of stakeholders external to the supply chain. As supply chain management changes from focusing on shareholder value through meeting only such goals as profitability to multi-stakeholder value by way of PPP objectives, this paper analyzes how AAA capabilities need to be extended, thus building on the views of Lee (2020).

The approach taken here is to view the supply chain in its ecosystem. While profitability, whether in the short or the long term, is the company's goal when the supply chain is considered in isolation, the people and planet goals become apparent when the supply chain is considered in its ecosystem. This is because in the isolated view, the company considers only stakeholders "internal" to the supply chain, whereas in the ecosystem view, there are "external" stakeholders that also need to be considered. The interests of these

external stakeholders are captured as people and planet goals. As a result, agility, adaptability, and alignment capabilities in the isolated view need to be understood in a more expansive way in the ecosystem.

The paper is organized as follows. In Section 2, we contrast the supply chain considered in isolation to when it is placed in its ecosystem. In Section 3, we discuss using examples what it means to extend agility from the isolated view to that in this ecosystem and do the same in Sections 4 and 5 with adaptability and alignment respectively. Section 6 concludes and offers some research opportunities.

2. The Supply Chain's Ecosystem and Stakeholders

Four developments took place between the late 1980s and early 1990s have expanded the scope of supply chain management. One development was China's Special Economic Zones offering tax incentives and less "red tape" for western firms to establish offshore manufacturing operations in China in the early 1990s. Supply chain management then required analyzing global manufacturing networks to incorporate local content requirements, customs and duties, and the differential tax rates in different countries (Cohen and Lee, 1989). The second was the growing industrial capability of China, starting in the 1980s, allowing both imports from Chinese companies and also outsourcing to them. The third was the desire of western companies to reduce assets and outsource to improve return on assets, leading to a graduated transition from offshored manufacturing in China to widespread outsourcing to contract manufacturers in China and other developing countries such as Bangladesh, Thailand, and Vietnam. The final development pertains to advances in digital communication that enabled western firms to communicate and coordinate their global (and possibly outsourced) supply-chain operations more efficiently (Starr et al. 2017).

2.1. Dynamics and Disruptions in the Supply Chain

Even before these four developments, OM researchers had already begun to examine the inherent challenges in long, and possibly decentralized, supply chains. One challenge was the so-called bullwhip effect, denoting the amplification of a variability in downstream customer demand into successively higher variability in the order quantity for upstream nodes in the supply chain. The effect had already been described by Forrester (1961) and popularized using the beer game that was studied, among others, by Sterman (1989), with case studies describing the experience of such firms as P&G and Hewlett Packard. The underlying causes and ways to mitigate this effect, however, were addressed only in 1997. According to Lee et al. (1997), even when each supply chain partner operates rationally and optimally, the bullwhip effect exists due to a number of causes. One cause is the demand information from downstream customers not being known to upstream partners, which led Lee et al. (2000) to examine benefits of sharing demand information with upstream partners.

Besides the causes for dynamics examined by Lee et al. (1997), global supply chains can be disrupted significantly with the supply network transmitting and amplifying the impact far from the origin. Disruptions include unanticipated increases in labor-related costs in outsourcing arrangements, inter-country trade wars or inter-company price wars, and disruptions such as port congestions, earthquakes, terrorist attacks, and pandemics (Sodhi, Son and Tang, 2012).

2.2. AAA Capabilities for the Supply Chain

Lee (2004) suggested that companies must develop AAA capabilities for their supply chains to generate profits from their supply chains. We define these capabilities as follows:

- ***Agility*** is the ability of the company to ensure its supply chain can respond quickly to short-term changes in demand across the entire product mix for all customers,
- ***Adaptability*** is the ability of the company to be able to adjust or even redesign the supply network to accommodate changes in supply or in the market, and
- ***Alignment*** is the ability of the company to be able to incentivize all supply chain partners to improve performance of the supply chain as a whole and increase profits for the lead company.

For instance, Seven-Eleven Japan (SEJ) has an *agile* supply chain supported by the use of an IT system to track sales pattern and customer product preference at every store with replenishment three times during the day. SEJ's supply chain is *adaptable* because of its multi-mode logistics network with helicopters, trucks, motorcycles. Indeed, following the 1995 Kobe earthquake, SEJ was able to provide deliveries to its stores within six hours. Finally, SEJ aligns its supply chain by using a reward-and-penalty system for its logistics providers.

2.3. The Isolated and the Ecosystem Views of the Supply Chains

Traditionally, supply chain is by and large "profit-driven" and supply chain management focuses on the coordination of flow of materials from raw material suppliers, components, and semi-finished goods from suppliers to the distribution of end products to consumers**.** ***Producers*** *(workers) and* supply chain partners by way of ***suppliers, manufacturers, distributors,*** and ***retailers*** are participants, and thus, stakeholders, in the profit-driven supply chain (**Figure 1**). The interactions among these "internal" stakeholders can be described through material and financial "flows" as depicted.

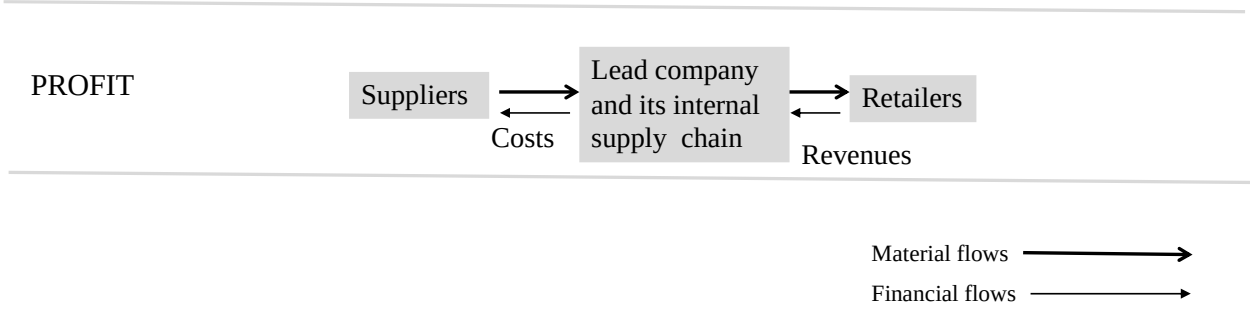

Figure 1. An isolated view of the profit-driven supply chain with only internal stakeholders

However, there is a larger picture that involves "external" stakeholders. The consumers are the "market" and, selling to them pressures companies to pay attention to, or at least advertise that they are paying attention to, planet- and people-focused goals to make more profits. To meet the demand generated by the consumers, each supply chain partner uses natural resources by way of water, energy, woods, metals, land use, etc. It also employs workers in its facilities and those of upstream supply-chain partners' facilities, possibly in less developed or emerging economies, to produce the products, which the lead company distributes to consumers in different geographical regions to maximize profits. However, the producers, supply chain partners (e.g., factories, logistic providers, and retailers), and consumers "consume" natural resources. And their activities inevitably generate wastes and emissions of solid wastes, toxic wastes, air pollutants, and water contaminants that damage natural resources.

To minimize the negative impact on the planet, these supply chain partners need to consume fewer natural resources, dispose of less waste, and emit fewer greenhouse gases in their decision-making and daily operations. Finally, to generate new revenue growth in an emerging market, companies need to help the poor producers break the poverty cycle so that they can become consumers later (Karnani 2007; Sodhi and Tang, 2014). As we incorporate these "external" stakeholders and the interactions with the planet and

the people within the system, one can take the ecosystem view of the supply chain and expand the scope from profits alone to include environmental and social sustainability goals **(Figure 2)**.

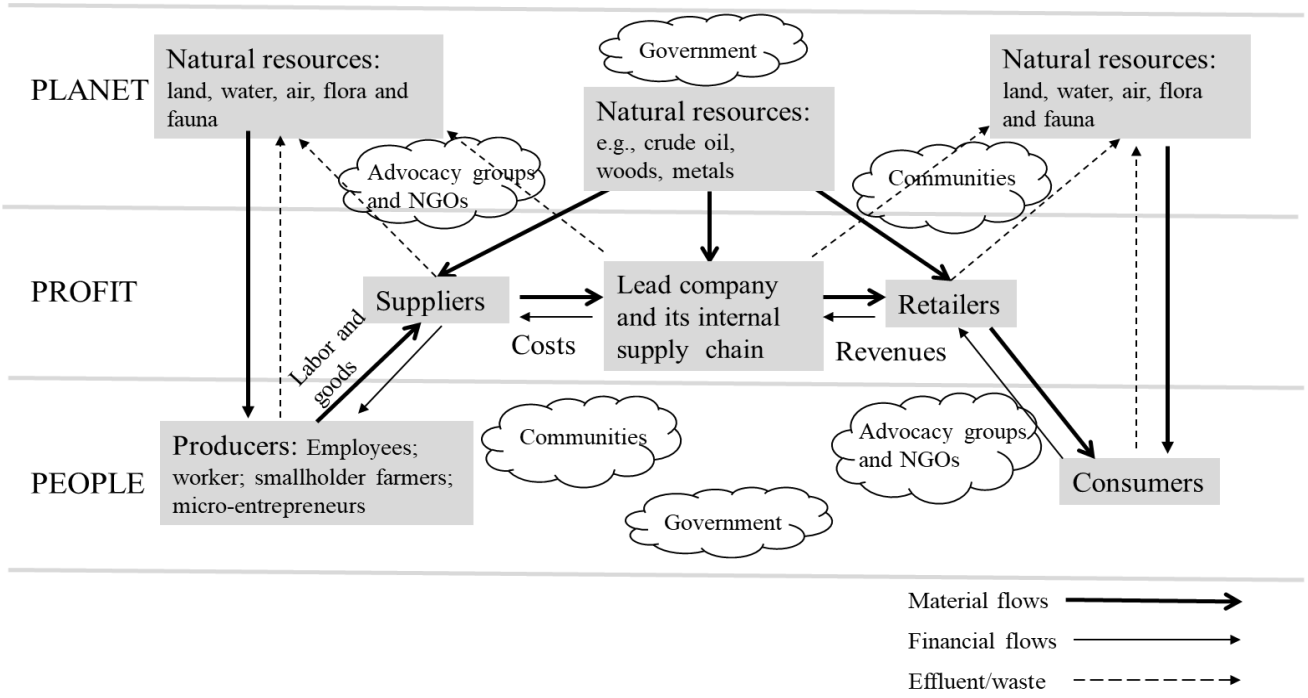

Figure 2. An ecosystem view of the supply chain including external stakeholders: Government, communities in which the supply chain has operations, and non-government organizations and advocacy groups seeking to control the exploitation of natural resource usage and to protect the interests of consumers, communities, and producers, or the environment

2.4. Why AAA Capabilities Need to be Extended

In the ecosystem (Figure 2), external stakeholders – governments, NGOs, and the society at large – have a stake in the operations of the supply chain despite being not being part of the supply chain. These external stakeholders seek to exert pressure on companies to consider their interests by way of people and planet issues. Facing this pressure, many firms try to deflect criticism from these external stakeholders – and

convince their consumers directly through advertisement –saying that they strive to "make money by doing good." For example, Nestlé has developed "Creating Shared Value" programs in Africa to ensure sustainable supply of high-quality cocoa beans for its chocolate production and Nescafé production (Lee et al., 2013). Specifically, Nestlé sources cocoa and coffee directly from farmers, provides training of sustainable farming practice, micro-loans, equipment assistance, etc., to help poor farmers to reduce their production and financial risks. These efforts help poor farmers, but Nestlé also improves profits by bolster its marketing efforts with consumers using specific "business cases" in their promotion efforts.

However, there is a question of incentives as it is possible that upstream partners pay higher costs for compliance while the lead firm reaps the benefits by way of higher revenues. Therefore, some supply chain partners have incentives to violate environmental, health-and-safety, and community-protection regulations to reduce the increase in the cost of compliance imposed by the lead firm. At the same time, the lead firm seeks higher revenues with consumers on the basis of claims that all entities in its supply chain comply with the regulations. Consequently, it is plausible to have misalignment of incentives in the ecosystem beyond price competition in the supply chain.

Besides alignment in the supply chain, governments need to establish and enforce various regulations on environmental sustainability, social responsibility, and fair business practices. Also, governments should hold lead firms responsible when their supply chain partners violate environmental as well as health and safety regulations. NGOs such as Greenpeace and Fair Labor Association can monitor the actual practices of different supply chain partners (Karnani, 2010), especially in the impact on local communities. As such, to create shareholder -- and even stakeholder -- value, companies need to go beyond the AAA capabilities in their supply chains (Table 1) by developing what we call PPP capabilities (**Figure 2**). In the next three sections, we elaborate on ways to extend each of these three capabilities.

Table 1: AAA capabilities in the isolated view of the supply chain and the extended capabilities when companies view the supply chain in its ecosystem

	Capabilities in isolated supply-chain view	**"Extended" capabilities for the supply chain in its ecosystem**
Agility	The ability to respond to short-term changes in demand quickly	Extended to reacting rapidly to changes in the very nature of this demand owing to the environmental, social or political context
Adaptability	The ability to adjust the supply network to accommodate significant market changes in demand or supply	Extended to rapidly modifying supply network to accommodate changes in demand and supply, as well as in environmental, social or political requirements
Alignment	The ability to establish incentives to entice all supply chain partners to improve the performance of the supply chain	Extended to (1) convincing external stakeholders to allow the supply chain to function smoothly, and (2) convincing consumers about the lead company's efforts in meeting generally accepted environmental and social goals

3. Extending Agility in the Ecosystem

Just as companies sense changes in demand quickly to ensure they can adjust their supply rapidly to meet that demand, in the ecosystem, they need to detect and respond to changing needs of consumers going well beyond just providing the product.

In the ecosystem view, product safety is critical, going well beyond product availability alone, which requires AAA capabilities in the isolated view of the supply chain. Many product-recalls occurred over the last decade. These recalls include Baxter's adulterated blood-thinning drug Heparin in 2007, Mattel's lead-tainted toys in 2008, China's adulterated milk formula in 2008, and Europe's horsemeat scandal in 2013. They have increased consumer's concern over harmful product adulterations (Tang and Babich, 2014). Between 2002 and 2010, the US Consumer Product Safety Commission (CPSC) recalled more than 1,500 goods imported from China. In 2012 alone, CPSC product safety inspectors managed to identify and halt over 650,000 unsafe Chinese products from entering the US market due to hazardous or banned substances -- including lead, phthalates, and cadmium -- or small parts that can cause suffocation.[1] In most cases, adulteration occurs when the contract manufacturer uses unapproved subcontractors that violate social or safety norms, provide sub-standard inputs, or use a sub-standard production process that skips quality checks to reduce costs.

To extend agility for quick response, companies are building track-and-trace capabilities along their supply chains. Many firms are using blockchain technology to track the provenance of products such as fish, pork, and coffee, to improve product safety.[2] For example, Walmart and nine other firms – Nestlé, Dole, Tyson Foods, Unilever, and others – partnered with IBM to use blockchain to track and trace provenance so that they can improve food safety and be more responsive to food recalls. Luxury-brand conglomerate LVMH, launched a blockchain platform in 2019 to track the origins of products to authenticate its luxury goods (Allison, 2019).

The same track-and-trace capability can enable a firm to improve its “people” performance in terms of fair remuneration, whether for workers or suppliers like farmers, or its "planet" performance by ensuring that environmentally friendly practices followed along the supply chain. Farmers in developing countries (and not only) get low and unstable wages (or prices) for their efforts. Denver’s Coda Coffee partnered

with a startup, bext360, to develop a blockchain that integrates machine vision, blockchain, cloud computing, and AI to trace coffee in every step: collecting, washing, drying, milling, export, and roasting of beans through retail operations (Philips, 2018). For instance, smallholder farmers in Uganda can deposit their produce into a "bextmachine" that uses 3D scanners, machine vision, and AI (machine learning) to determine the quantity and quality of the coffee beans. Then the machine issues a receipt to farmers to collect fair payments.

Thus, agility, as a capability for a supply chain in isolation, has an extended meaning for the same supply chain in the ecosystem view.

4. Extending Adaptability in the Ecosystem

Firms must have full visibility about their global supply chain operations to adapt to any supply chain disruptions to facilitate adaptability even in the isolated view of the supply chain (Tang 2006; Sodhi and Tang 2019). However, a supply chain is never operated in isolation. Companies need to comply with government regulations as well as adhere to trade agreements or labor standards. Local governments, NGOs and consumer activists monitor the company's operations in the extended supply chain (Figure 2). To be sure, there are potential disruptions or other drastic changes in the supply chain that threaten profitability, but there may be risks to people and planet goals as well (Table 2).

Table 2. Supply chain risks that affect the PPP performance negatively

Risks incurred by suppliers that can affect profit, people and planet (PPP) performance negatively	**Supplier's Risky Behavior**

Materials risks that can affect the "people" performance	Suppliers use materials that violate agreements/regulations. These materials include conflict minerals and GMO ingredients for food products.
Product risks that affect the "people" performance	Suppliers produce unsafe products using unsafe materials (e.g., lead and cadmium in toys, melamine in food products, etc.)
Worker safety risks that affect the "people" performance	Suppliers create an unsafe workplace due to dangerous buildings and forced child labor.
Environmental risks that affect the "planet" performance	Suppliers violated environmental regulations
Product development risks that affect the "profit" performance	Suppliers unable to develop modules/components of a new product for their customers
Product delivery risks that affect the "profit" performance	Suppliers fail to deliver on time.

Gaining visibility about the suppliers' capabilities and operations can enable firms to develop adaptive strategies to improve not only their profits but also their PPP goals. Consider the following examples. First, product development risk can affect a firm's "profit" performance. Tang and Zimmerman (2009) argued that had Boeing obtained full visibility about the true capabilities of suppliers in different tiers of its global supply chain, Boeing would have saved time and costs in its 787 development. More importantly, had Boeing gained full visibility and control of the software quality developed by its software supplier HCL, the company could have prevented the crashes of 737 Max planes in 2019 (Robison, 2019).

Second, companies can develop different auditing/inspection mechanisms for improving social responsibility that can affect the "people" performance with enhanced supply chain visibility. Chipmaker Intel has conducted surveys, visited different smelters, conducted on the ground interviews, and supported independent audits since 2013 to ensure the company is using conflict-free minerals for its

microprocessor manufacturing. Also, after the collapse of Rana Plaza in 2013, over 200 apparel brands, retailers and importers worked with various trade unions and NGOs to establish the ACCORD (on fire and building safety in Bangladesh) in 2013 to conduct independent audits of different factory buildings to ensure building safety (Caro et al. 2018).

Finally, companies should gain visibility into their suppliers' operations to ensure compliance with environmental regulations to improve the "planet" performance. In 2011, IPE,[3] an NGO based in Beijing published a report detailing various alleged malpractices (factory workers getting poisoned and even disabled, with entire communities faced with pollution) in Apple's supply chain in China (Schroeder 2011). In response, Apple developed its "supplier responsibility" program to improve its visibility about its supplier's environment, health & safety performance and conducted independent audits of its Chinese suppliers for labor rights violations and environmental violations since 2011 (Sodhi and Tang, 2019).

Thus, adaptability as a capability – using, for instance, visibility – for a supply chain in isolation has an extended meaning in the supply chains' ecosystem.

5. Extending Alignment in the Ecosystem

A company knows that incentives need to be aligned not only with supply-chain partners but also with external stakeholders in the ecosystem. At the very least, such alignment requires that the lead company seeking profits is not hurting the interests of the external stakeholders.

Many companies seek to show they are managing the interest of the external stakeholders by disclosing provenance information, including suppliers, regions of manufacture, materials used, or methods of manufacturing. The ability of a company to trace the path of materials it uses back up the supply chain is called supply chain traceability. If a company develops this ability, it may disclose some of the

information it has strategically or at least seeks to convince consumers that it has this ability and is using it not to harm the interests of some external stakeholders. When the German animal-rights organization Four Paws accused Patagonia of using live-plucked down from geese that farmers were also force-feeding for foie gras, Patagonia developed a "traceable down" initiative to trace the sourced down to the farm. It can, therefore, assure consumers that the down it uses for its products and is not furthering live-plucking or force-feeding. This way, customers are willing to pay a higher price for Patagonia products, improving the company's profits. Thus, Patagonia successfully aligns consumers' interests in avoiding unnecessary cruelty with its interests to increase profits.

Similarly, Li & Fung[4] created a new business unit called Vendor Support Services (VSS) in 2014 to help its suppliers to improve their operations while complying better with environmental norms and regulations. VSS works with suppliers to measure greenhouse gas emissions and water usage and to help them to use energy and natural resources more efficiently. As the resulting changes help suppliers to become more productive, they have an incentive to adopt sustainable practices in the long run. As suppliers become more cost-efficient and more environmentally friendly, Li & Fung improves its “planet” and “profit” performance (Lee and Tang, 2018).

NGOs and other advocacy groups representing social interests can also put explicit pressure on large corporations to improve environmental performance in their supply chains. Beijing-based non-profit research organization, IPE, developed the Green Choice Alliance (GCA) with various NGO organizations to push global corporations to improve the environmental performance of their suppliers. IPE provides information about the performance of brands such as Apple, Walmart, Adidas, etc., and their responses and actions in improving the environmental performance of their supply chains. Also, IPE has also developed an index, CITI, to evaluate each international brand’s “planet” performance in terms of its

environmental management of its supply chain in China. This ranking system incentivizes international firms to work closely with their Chinese suppliers to improve their "planet" performance.

Governments impose environmental, health and safety (EH&S) regulations in all countries. However, due to lax law enforcement in many developing countries and with pressure from western buyers, suppliers may not comply with such regulations. The result is such violations as release of toxic waste and buildings with fire hazards. After the collapse of Rana Plaza in 2013 that killed over 1,133 workers and injured thousands more (Lee and Melvin 2015), multinational retailers felt under pressure to improve the EH&S compliance of their suppliers in Bangladesh, China, and Vietnam. Over 200 apparel brands and two global trade unions signed an agreement, ACCORD, on fire and building safety in Bangladesh (and reaffirmed the agreement in 2018 in a Transition Accord). The idea is to ensure building safety by conducting independent audits of different factory buildings. The ACCORD members developed a "collective penalty clause" so that all customers would cancel their contract with the supplier if its factory failed to take corrective actions to ensure building safety (Caro et al. 2018). This collective penalty clause provides a strong incentive for suppliers to comply. Since inception, ACCORD inspectors have identified more than 122,000 safety violations. By October 2018, over 90% of the safety hazards identified in the original round of inspections have been reported or verified as fixed, helping western retailers meet their people-related goals.

As another example of meeting people- and planet-related goals, consider Starbucks and its CAFE program, which the company launched to assure the supply of high-quality and 'sustainability'-branded coffee beans. The program helps farmers adopt such environmentally sustainable farming practices as organic farming and drip irrigation. The company donates disease-resistant trees -- with a goal of 100 million trees by 2025 -- to help farmers fight such threats as coffee-leaf rust. Starbucks also works with NGOs (e.g., Rainforest Alliance) to ensure farmers are compensated fairly for their sustainable farming

practices. The cost of coffee to Starbucks in a cup sold to a consumer is estimated to be about only 1 percent of the price the consumer pays, so a higher price to the farmer does not hurt Starbucks' profit goals.

Thus, alignment as a supply-chain capability takes on an extended meaning in the supply chain's ecosystem with people and planet goals.

6. Conclusion and Research Opportunities

Once a company moves away from the isolated view of the supply chain for profits (**Figure 1**) and embraces the ecosystem view (**Figure 2**) for people and the planet, it also needs to extend its AAA capabilities. We have shown how some companies are doing so, acceding to regulators and consumer and community advocacy groups to make things better for the people and the planet, in part motivated for more profits.

The expanded view of the supply chain in its ecosystem provides opportunities for research. With a large number of stakeholders, invariably, some stakeholders' interests will be harmed to the benefit of other stakeholders. For instance, Apple and Starbucks are well known for avoiding taxes in Europe. Although European governments are seeking to assert their interests, they have also been threatened by the US government even though these companies have distribution, sales, and customer services in these countries. Besides the lever of transfer pricing, these firms have also used the power of the US government behind them. So, one obvious question is to understand the ecosystem better by mapping the links between such companies and the governments of countries where they have headquarters and of countries where they have sales or supply chain operations. In general, *how do large companies leverage one external stakeholder against another to further their own goals from their supply chains*?

Elected governments in many countries, as of writing, are asking for more manufacturing to be done inside their countries. For instance, there are the 'Make America Great Again' or 'Make in India' campaigns in the US and India, respectively. It is unclear whether supply chains have changed or not, but it would be interesting to understand such questions as *to how changes (e.g., trade wars) in the ecosystem cause changes in the supply chain structure*.

Arranging by stakeholder is consistent with the *stakeholder resource-based view* (SRBV) of the firm, a framework to guide the decision-making of managers. Managers develop their own organization's capabilities and resources for competitive advantage as per the resource-based view of the firm. But they also do so for stakeholders, whose utility depends on the managers' decisions (Sodhi, 2015). The framework helps identify descriptive (what is?), instrumental (how does?), and normative (how should?) research questions. Researchers can examine these topics with field experiments, behavioral experiments, empirical analysis, and mathematical analysis, or using multiple methods to create *research streams* (Sodhi and Tang, 2014b).

Among the questions to consider for the multi-stakeholder ecosystem view of the supply chain are: *How can companies collaborate with their suppliers to improve transparency*? Given the increasing use of technology, another question is: *How should a company (or a consortium) use technologies such as blockchain or other track-and-trace technology with suppliers to enable greater supply chain visibility as well as transparency to meet people and planet goals*? With NGOs representing people and planet interests, *how are companies collaborating with NGOs, and how should they*? There are questions on the government or regulators. For instance, *how should monitoring agencies require transparency for the benefit of consumers (or workers and their communities) in the face of political lobbying by companies*? *How can regulators induce companies to measure and report the quantity and impact of post-consumer waste from their products and packaging*?

Overall, the ecosystem approach affords a multi-party game of supply chains with opportunistic alliances between different parties. One set is senior managers of companies representing shareholders and their interests. Another party comprises elected government officials in the countries where the company operates and in the country where it has headquarters. A third set includes advocacy groups representing the interests of communities, the environment, and consumers. As a starting point, it may be useful to understand what kind of alliances form, whether to the benefit or the detriment of the other stakeholders.

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Notes

[1] Other general items included Christmas lights and electric appliances (fire/electric shock hazards) and shoes and furniture (banned substance dimethylfumarate, a mold-proof agent that can damage human skin).

[2] A Blockchain is a distributed and secure ledger (Olsen and Tomlin, 2020). The ledger can be written and accessed by different (possibly authorized) entities, with its data stored on a peer-to-peer network. Once someone creates information as "block" to the chain, no one else can alter this information unilaterally. Babich and Hilary (2020) provide a comprehensive discussion about the strengths and weaknesses of blockchain ranging from lack of privacy, garbage-in-garbage-out, inefficient, etc.)

[3] In 2008, the Chinese Environment Ministry required environmental agencies to disclose information on the regional environment and reveal the enterprises violating discharge standards within 20 days on the agency's website or through the press. IPE collected data from different agencies and developed a single online platform to provide information in Chinese and English about water and air pollution in China.

[4] By managing a global supply network of over 15,000 suppliers, Li & Fung is one of the largest trading companies providing design, development, sourcing and distribution services to retailers, brand owners and wholesalers around the world (Fung et al. 2008). Without owning any factories, Li & Fung leverages its agile global supply network to meet the changing needs of its customers (Tang 2006).